THE FIRST ARTICULATED FRESHWATER TELEOST FISH FROM THE CRETACEOUS OF NORTH AMERICA

by LANCE GRANDE

ABSTRACT. *Chandlerichthys strickeri* n. gen. et sp., represented by two articulated specimens, is described from Middle Cretaceous deposits of the north slope of Alaska. This is the first articulated teleost species positively of Cretaceous age that has been found in freshwater deposits of North America. Although preservation is insufficient to permit detailed morphological description of the skull and caudal skeleton, it appears to be an osteoglossomorph.

DURING August 1984 Mr Gary Stricker, a geologist for the USGS, discovered a nearly complete, but poorly preserved, fish from freshwater deposits of Albian or Cenomanian age on the North Slope of Alaska (text-fig. 1). The specimen (text-figs. 2 and 3), described here, was discovered on a large sandstone block with another partial specimen (text-fig. 4). Mr Stricker spent several hours at the locality looking for additional specimens but could find none. Because the specimens are preserved as little more than thin carbon film, a detailed description of the skull and caudal skeleton is not possible. The specimens were nevertheless thought to be worthy of description because of their locality and geologic age. This locality is the first known freshwater Cretaceous deposit in North America to produce an articulated teleost skeleton (with the possible exception of *Ostariostoma wilseyi* Schaeffer, 1949, which is thought to be either Paleocene or Late Cretaceous). The only other nearly complete articulated fishes of any kind described from Cretaceous freshwater deposits of North America are two non-teleost species. *Paleopsephurus wilsoni* MacAlpin, 1947 and *Protoscaphirhynchus squamosus* Wilimovsky, 1956. *Paleopsephurus* appears to be a polyodontid (although Gardiner (1984) believes it to be the sister-group to Acipenseridae), and *Protoscaphirhynchus* (described as an acipenserid) is a non-teleost actinopterygian of unknown affinity (also discussed in Gardiner 1984).

SIGNIFICANCE OF FRESHWATER CRETACEOUS TELEOSTS

The Cretaceous is a very significant period for studies of the freshwater teleost fauna of North America, because between Jurassic and Paleocene times there is a complete change in the fauna. Prior to the Cretaceous the North American freshwater fish fauna is primarily non-teleost, and the few teleosts present (i.e. ichthyodectids, *incertae sedis*) (Schaeffer 1967, Schaeffer and Patterson 1984) have not been found to be closely related to any Paleocene to Recent teleosts. The well-documented Paleocene freshwater fish fauna is made up primarily of teleost species that belong to modern groups such as Clupeidae (Grande 1982), Hiodontidae, Esocidae, Percopsidae, Cyprinoidea, Gonorynchidae, and Osteoglossidae (Wilson 1980 and pers. comm.), and Ictaluridae (Lundberg 1975, p. 11). This newly discovered fish *Chandlerichthys strickeri* n. gen. et sp. represents a clue to which freshwater teleosts were in North America between the Jurassic and the Paleocene.

METHODS

The type was examined wet (soaked in water) and in daylight or low, diffuse electric light. When the specimen is examined dry or under bright microscope light, observed morphological detail

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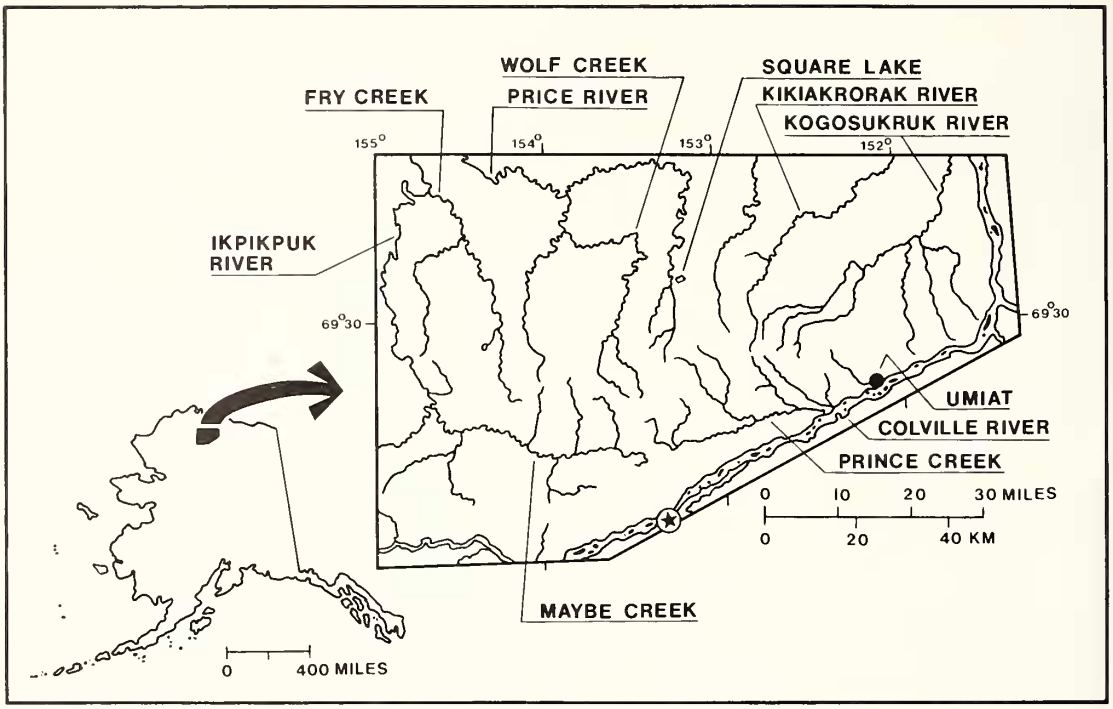
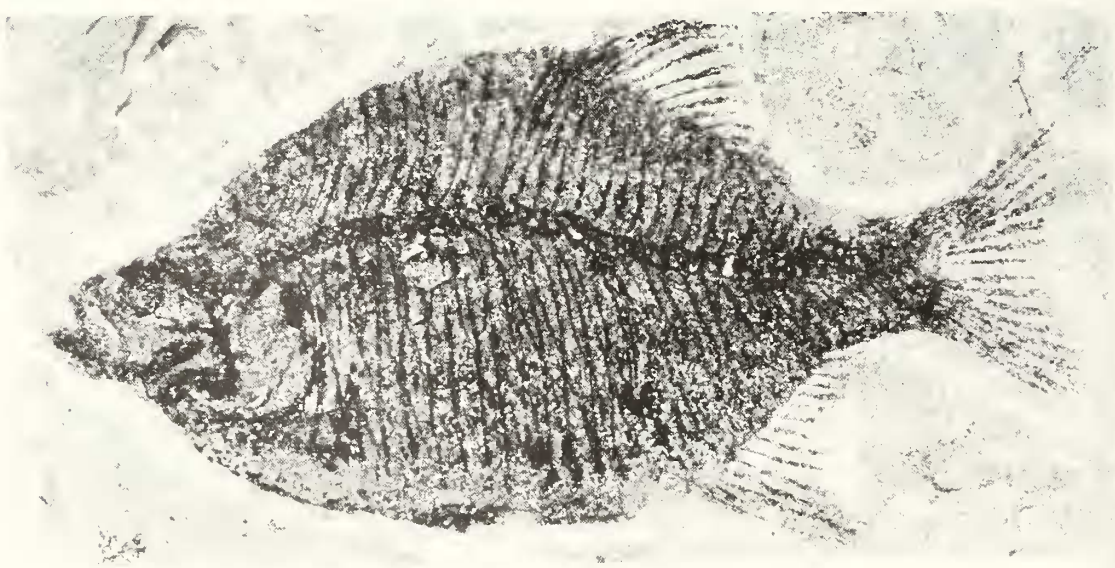
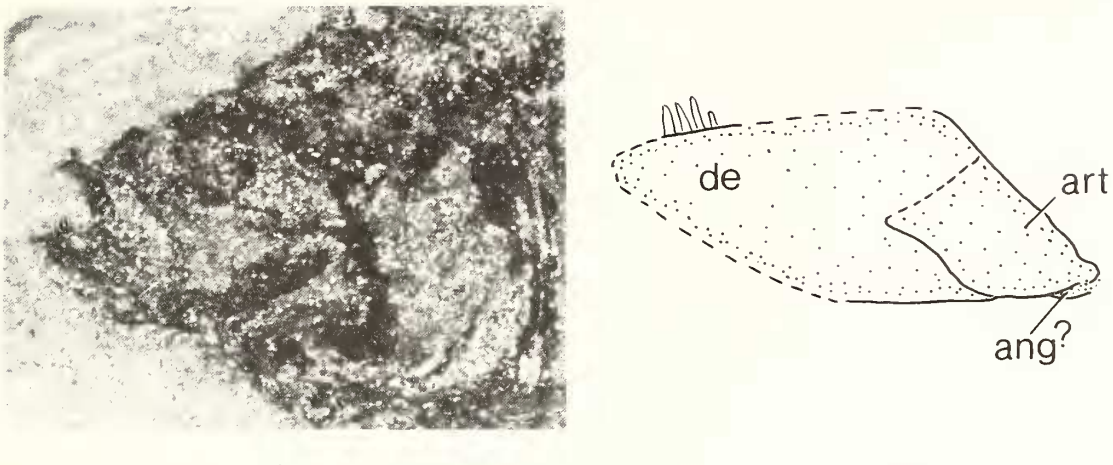


TEXT-FIG. 1. Map showing locality (star) for *Chandlerichthys strickeri* n. gen. et sp.



TEXT-FIG. 2. *Chandlerichthys strickeri* n. gen. et sp., holotype (USNM 336567), standard length 108 mm, from Cretaceous freshwater deposits of the north slope of Alaska.

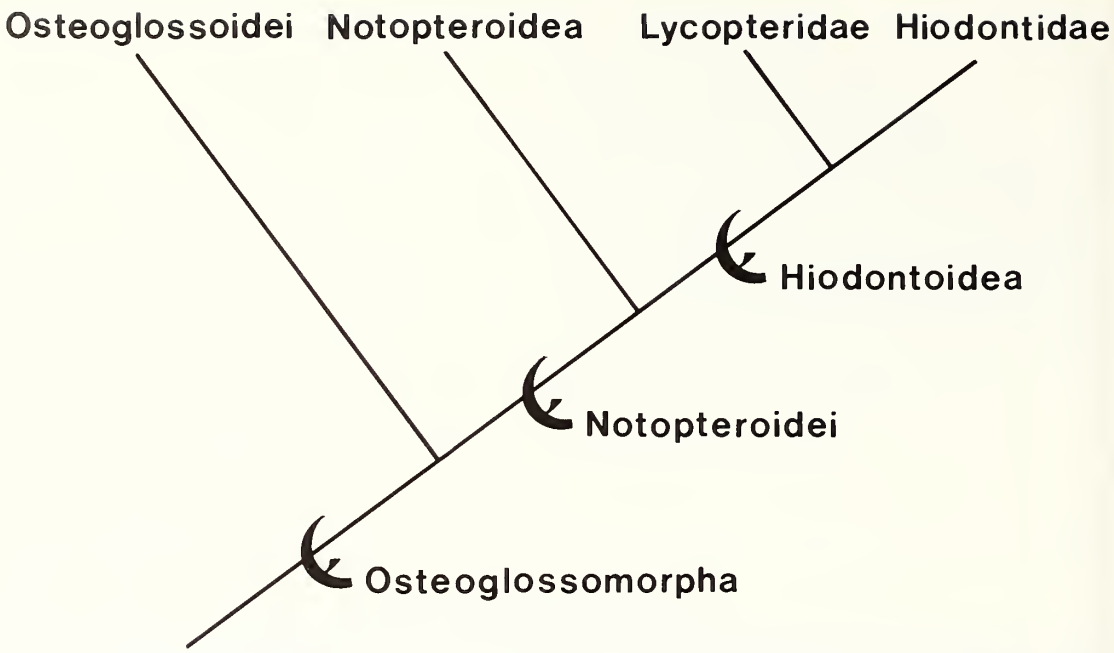


TEXT-FIG. 3. *Chandlerichthys strickeri* n. gen. et sp., A, enlarged photograph of head region of specimen in text-fig. 2, B, drawing of lower jaw from text-fig. 3A showing teeth on dentary. ang, angular; art, articular; de, dentary.

TEXT-FIG. 4. *Chandlerichthys strickeri* n. gen. et sp., referred and only other known specimen (USNM 336567), standard length, 57 mm. Originally from same block of matrix as holotype. Dashed line represents probable body outline where specimen is broken.

decreases significantly (due to mica in the matrix, low relief of the bones, and low contrast between fish and dry matrix).

Standard length was measured from the anterior tip of the snout to the posterior end of what appears to be the third hypural. Preanal length was measured from the tip of the snout to the base of the most anterior anal fin ray. All other counts and measurements were made as outlined by Hubbs and Lagler (1949).



TEXT-FIG. 5. Phylogeny of osteoglossomorph fishes based on Patterson and Rosen (1977).

All names for exclusively fossil taxa are preceded by a dagger symbol. The osteoglossomorph classification used here is shown in text-fig. 5.

SYSTEMATIC DESCRIPTION

Division TELEOSTEI (*sensu* Patterson and Rosen, 1977)
Supercohort OSTEOGLOSSOMORPHA (*sensu* Patterson and Rosen, 1977)
Cohort, order and family *incertae sedis*
Chandlerichthys gen. nov.

Diagnosis. It is unlike any other known teleost in the following combination of characters: Very deep bodied (body depth = 57% of standard length) with median fins set far back on body, caudal fin slightly forked, with eighteen principal rays (1, 8, 8, 1) and a very small head and narrow caudal peduncle; pectoral fin with numerous (20) but weakly developed rays.

Etymology. *Chandler*—after the Formation where the type specimen was discovered, *ichthys*—a fish.

Type and only species: *Chandlerichthys strickeri* sp. nov.

Chandlerichthys strickeri n. gen. et sp., text-figs. 2–4

Diagnosis. As for genus, only species; known size range 57–108 mm sl.

Type specimen. USNM 336567 (text-figs. 2 and 3), a completely articulated fish poorly preserved as a carbon film on a gray micaceous medium-grained sandstone. Standard length, 108 mm.

Referred specimen. USNM 336568 (text-fig. 4), a partial specimen preserved like holotype. Standard length, 57 mm.

Locality. Freshwater deposits of the Killik Tongue of the Chandler Formation (Nanushauk Group), Arctic

Slope of north Alaska, latitude 68°13′7″N and longitude 153°25′45″ on the south bank of the Colville River (text-fig. 1).

Brosge and Whittington (1966) interpreted the sandstone, siltstone, shale and coal of the Killik tongue as having been deposited in fluvial and related environments. Although several marine phases of the Nanushuk Group have also been identified (May 1979), the fossil fish described here was collected among channel and splay deposits in a fluvial sandstone within a meter or two of coal beds in either direction (Stricker, pers. comm.). Geologic maps of the area are still in preparation by the USGS. Roehler (in press: fig. 10) illustrates the type locality and refers to it as part of the Upper Delta Plain consisting of channels, splays, and coals. Plant fossils indicate that the climate of the Alaskan North Slope during Albian time was subtropical to warm temperate (Scott and Smiley 1979, p. 97).

Age. Albian, or possibly earliest Cenomanian.

Etymology. *strickeri*—after Mr Gary Stricker, the geologist who discovered the specimen.

Description (*of holotype except where noted*). Deep bodied, laterally compressed teleost. Total length 129 mm, standard length 108 mm (referred specimen, 57 mm). Other measurements as percentage of standard length: body depth (57%), head length (29%), prepectoral (29%), predorsal (64%), pre anal (77%), caudal peduncle depth (14%), caudal peduncle length (21%), dorsal fin base (19%), and anal fin base (20%).

Meristic data: vertebrae 37 preural (18 caudal, 19 precaudal); ribs 17 pairs; principal dorsal fin rays 12; dorsal pterygiophores 12; principal anal fin rays 14; anal pterygiophores 14; pectoral rays 20; pelvic probably weak or absent (not preserved on specimen); predorsal bones 11; caudal fin 1, 8, 8, 1 (one unbranched and eight branched rays in each lobe).

Median fins are relatively posterior in position, both well behind the midpoint of the body (text-fig. 2) (only dorsal and upper lobe of caudal preserved on referred specimen). Anal insertion well behind dorsal insertion and about vertical with posterior end of dorsal fin base. Principal dorsal fin rays are preceded by four or five small unbranched accessory rays, and anal is preceded by two or three. Caudal fin is slightly forked with rounded lobes. Vertebral column is arched over the abdominal area. There are two ural centra, the first of which is slightly longer than the first preural centrum, and the second of which is reduced in size. Preservation of scales was insufficient to allow their description, but they appear to be not as heavy as in Osteoglossidae. No scutes or fin spines were observed. Eye appears large (base on preserved pigment) and the head and caudal peduncle are very small in proportion to the rest of the body. The head has an anteriorly pinched-off profile that is not due to distortion. This profile is also apparent in the referred specimen (text-fig. 4). There appear to be a few caniniform teeth preserved in the lower jaw, which is deep and more osteoglossid-like than hiodontid-like (text-fig. 3). Anterior arm of preopercle less than half the length of the vertical arm. Orbit extends posterior to jaw articulation.

DISCUSSION

Of the known major teleost groups, *Chandlerichthys* appears to most closely resemble Osteoglossomorpha. As in primitive osteoglossomorphs (e.g. hiodontoids and the osteoglossoid *Phareodus*), there are sixteen branched caudal rays, posteriorly set median fins, caniniform teeth set in a deep dentary, and a large eye. The moderately forked tail is similar to that of hiodontoids and *Phareodus* and unlike Recent osteoglossoids, which all have a posteriorly rounded caudal fin. *Chandlerichthys* also lacks any recognizable character that would place it in another teleost group (i.e. no scutes, fin-spines, weberian apparatus, etc.). Remnants of scales are broken up with irregular edges, suggesting that they may have been reticulate as in osteoglossoids. The general body shape of *Chandlerichthys* is similar to that of the osteoglossoid *Phareodus* (e.g. Grande 1984, fig. II 34a) and *Yungkangithys* (a deep bodied lycopterid illustrated in Chang and Chou, 1977, fig. 10). Unlike *Phareodus* there is no enlargement of the anterior pectoral rays; unlike *Yungkangichthys*, the predorsal bones point anterodorsally, and the vertebrae are not massive. The vertebral number (39) is low for Osteoglossomorpha, but some fossil hiodontoids and Osteoglossomorpha *incertae sedis* approach this number. Greenwood, 1970, lists lycopterids with as few as forty-three; Takai 1943, lists some lycopterid species with as few as forty. *Kipalaichthys sekirskyi* Casier 1965, from the Lower Cenomanian of Zaire and placed in Osteoglossomorpha by Tavern (1979), also has a low number of vertebrae (38–40). The arch of the vertebral column over the abdominal area

(text-fig. 2) is unlike other known osteoglossomorphs, and possibly related to the extremely small head. Other osteoglossomorphs (e.g. *Phareodus* in Grande 1984, figs. II. 36a–h) have a nearly straight vertebral column. Whether *Chandlerichthys* belongs in Osteoglossoidei or Notopteroidei (Hiodontoidea + Notopteroidea) cannot be confidently determined based on the available specimens. Admittedly, placement of *Chandlerichthys* even in Osteoglossomorpha rests largely on overall resemblance and biogeography.

There is a possibility that the downturned anterior curvature of the vertebral column in the holotype is pathological. This area of the vertebral column is missing in the second specimen. The peculiar body outline with the very deep body, narrow caudal peduncle, and pinched-off head profile is not likely to be pathological, though, because the second specimen (text-fig. 4) also shows this.

Osteoglossomorpha, a group of 'primary freshwater fishes' (Darlington 1957; Patterson 1981), are represented today in North America by only two living species (*Hiodon alosoides* and *H. tergisus*), and no living Osteoglossoidea or Notopteroidea. The fossil record, however, is more diverse. Well preserved Osteoglossoidea are abundant in Eocene freshwater deposits of the western United States. With at least two species of *Phareodus*. Fossil Hiodontoidea are represented in western North America by species described from Paleocene (Wilson 1980), Eocene (Cavender 1966; Wilson 1977, 1978; Grande 1979) and Oligocene (Cavender 1968) freshwater deposits. All of the North American hiodontoids are in Hiodontidae, which are restricted to North America. (*Chetungichthys brevicephalus* Chang and Chou (1977) from Late Mesozoic deposits of China was identified as '?Osteoglossiformes, ?Hyodontidae'; due to the uncertainty of the original identification, and to the lack of morphological evidence in type description, this species is not included in the family here. Specimens were not available for this study.) The Hiodontidae are thought by most ichthyologists (e.g. Greenwood 1970; Patterson and Rosen 1977; Taverne 1979) to be most closely related to the fossil family Lycopteridae (text-fig. 5). The Lycopteridae are known from Upper Jurassic to Lower Cretaceous time, and are known only from eastern Asia in lacustrine deposits (Greenwood 1970; Takai 1943; Liu *et al.*, 1963; Gaudant 1968; Chang and Chou 1976).

Additional material is needed for a more positive taxonomic placement of *Chandlerichthys*. Unfortunately, it seems unlikely that such material will come to light in the near future, given the difficult access to the type locality.

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